Argus III System Upgrade Grant

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http://cil-www.coas.oregonstate.edu:8080

NOTE – This grant is for upgrades to the Argus Observing Program and primarily funds purchase of off-the-shelf components tested under a companion grant, Optical Imaging of the Nearshore, N00014-02-1-0154.

LONG-TERM GOAL

The long-term goal of neashore processes research has been to develop a predictive understanding of the fluid dynamics of a random wave field shoaling over the complicated bathymetry of a natural beach, and the response of the beach to those overlying wave and current motions. Due to the complexity and nonlinearities of the system, predictions at most time scales depend on frequent data updates, likely acquired through innovative remote sensing techniques. The Argus Program, developed by the Coastal Imaging Lab (CIL), is one such approach (http://cil-www.coas.oregonstate.edu:8080). Technology developments in Argus are important to a range of nearshore dynamics research programs and apply readily to other remote sensing programs of Naval interest.

OBJECTIVES

The CIL currently supports 12 stations in 5 countries. The hardware and software technology behind Argus has evolved considerably over the 20+ years since the CIL adopted optical methods for nearshore studies. The objective of the current DURIP grant is to purchase equipment for the third generation of Argus and to upgrade the stations in Argus network.

APPROACH

As this is a DURIP, the approach to this work is to simply buy the new equipment and use it to replace existing station (where appropriate)

WORK COMPLETED

The initial Argus III test station was deployed during the NCEX in the fall of 2003. Lessons from that deployment have lead to revisions and further testing. In the summer of 2004, a new station was installed at the Hinsdale Wave Lab at Oregon State University (the first laboratory installation of Argus). Wholesale upgrades to the remaining Argus stations have been slowed by development details

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14. ABSTRACT

The long-term goal of neashore processes research has been to develop a predictive understanding of the fluid dynamics of a random wave field shoaling over the complicated bathymetry of a natural beach, and the response of the beach to those overlying wave and current motions. Due to the complexity and nonlinearities of the system, predictions at most time scales depend on frequent data updates, likely acquired through innovative remote sensing techniques. The Argus Program, developed by the Coastal Imaging Lab (CIL), is one such approach (http://cil-www.coas.oregonstate.edu:8080). Technology developments in Argus are important to a range of nearshore dynamics research programs and apply readily to other remote sensing programs of Naval interest.

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of dealing with the evolving FireWire IEEE standards (and implementations thereof by individual camera manufacturers). We have finally settled on PixelFly cameras and are proceeding with final installations.

We continue to improve the foundation algorithms for Argus. Drawing from developments from computer imaging, we have upgraded our camera projection algorithms to now be based on homogeneous coordinates [*Hartley and Zisserman*, 2003], that should offer many advantages and simplifications. For example, figure 1 shows a merged virtual image of an active rip current system from the NCEX experiment. Calculation of virtual images such as these is simple with the new algorithms. Re-projection of UAV imagery onto a common surface is an important future application.

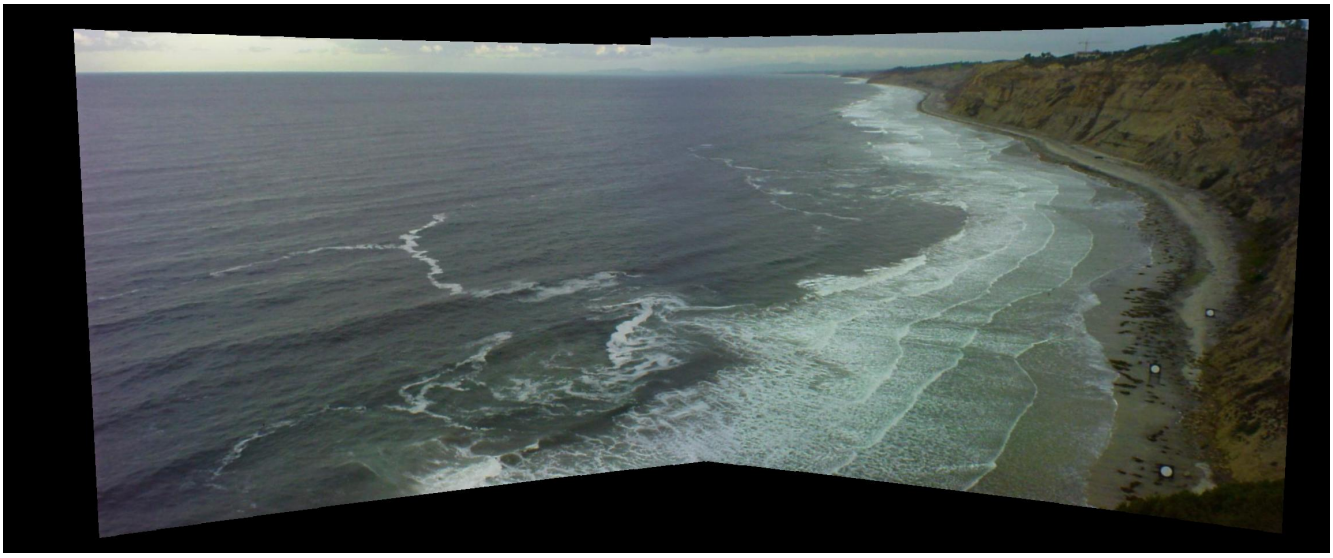

Figure 1. Merged oblique image of an active rip current system from the NCEX experiment. This composite image is computed from two individual images using homogeneous coordinates. Alternate projections can be found trivially.

IMPACT/APPLICATION

Argus has become increasing important in Europe and Australia, with installations now in seven countries over three continents and serious Argus research in five countries. Approximately 35 stations are now in operation. Within the US, Argus and associated spin-offs will play a major role in the NCEX field experiment, now in progress. Argus is also an increasingly important part of Naval nearshore remote sensing research, for example in the VISSER program, run by Dr. Todd Holland at NRL-Stennis Space Center.

TRANSITIONS

Aspects of Argus research development have been integrated in Naval nearshore remote sensing programs through the PI's connections to the LRS program. Transition to the WSC of some of these results is ongoing or complete as of the time of writing.

RELATED PROJECTS

1 - Joint work with Dr. Todd Holland, NRL-SSC

2 – Collaboration with WSC personnel at Navoceano on nearshore remote sensing

3 – LRS program collaboration

4 – EU CoastView Program (2002 – 2005)

5 – Numerous collaborations with the Field Research Facility

6 – Participation in the NCEX field experiment, 09/19/03 – 11/15/03

7 – Collaboration with the Ocean Engineering Group at OSU

REFERENCES

Hartley, R., and A. Zisserman, *Multiple view geometry in computer vision*, 665 pp., Cambridge University Press, 2003.

PUBLICATIONS

Holman, R.A. Stanley, J.A, and H.T. Özkan-Haller, The application of video sensor networks to the study of nearshore oceanography, IEEE Journal of Pervasive Computing, 2(4), 14-21, 2003.

Holman, R.A. and J. Stanley, The history, capabilities and future of Argus, Coastal Engineering, in review.

HONORS/AWARDS/PRIZES

SECNAV/CNO Chair in Oceanography, 2003-2007